Mapping the barriers for implementing halal logistics in Indonesian food, beverage and ingredient companies

Aries Susanty, Nia Budi Puspitasari and Avika Dian Caterina
Department of Industrial Engineering, Diponegoro University, Semarang, Indonesia, and

Sumunar Jati
The Assessment Institute for Foods, Drugs, and Cosmetics – The Indonesian Council of Ulama, Bogor, Indonesia

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Abstract

Purpose – This study aims to identify the barriers to halal logistics implementation; rank the barriers of halal logistics implementation in food, beverage and ingredient companies; and identify the relationship among the identified barriers of halal logistics implementation to derive key managerial insights.

Design/methodology/approach – The paper first describes the concepts of halal logistics and discusses the barriers in implementing halal logistics from previous research studies. Then, on the basis of previous research, this study identifies 13 barriers to halal logistics implementation. The study uses interpretive structural modelling (ISM) methodology to find the rank of the barriers and also the direct or indirect relationship among those barriers. The study also uses a panel of experts consisting of the representative from Lembaga Pengkajian Pangan, Obat-obatan, dan Kosmetika Majelis Ulama Indonesia (The Assessment Institute for Foods, Drugs, and Cosmetics – The Indonesian Council of Ulama or LPPOM MUI) and the representatives from 23 food, beverage and ingredient companies to determine the rank of, and the relationship among, the 13 barriers.

Findings – The result of data processing with ISM methodology indicated that lack of support for logistic service providers and lack of customer demand and reluctance to pay for halal logistics occupied the topmost level. These barriers are affected at the lower level and have less influence than the remaining barriers. The result with ISM methodology also indicated that lack of commitment of management is the main barrier to implementing halal logistics. Moreover, according to the result of data processing with ISM methodology, this study suggests some managerial implications to overcome the barriers that hinder halal logistics implementation.

Research limitations/implications – This study has several limitations. First, the scope of the study is limited to the barriers faced by Indonesian food, beverage and ingredient companies and overlooks other barriers to halal logistics encountered by other industries or other services as well as other regions or countries (i.e. other Muslim or non-Muslim countries). Future studies should attempt to uncover other industries or other services or a cross-industry comparison as well as other regions, other countries or a cross-region or cross-country comparison. The second limitation is related to the possibility of biased opinions from the experts, and the third limitation is that the identified barriers do not test in a real environment. To eliminate these limitations, future studies should involve more experts from different areas of the halal industry and should test the identified barriers to implement halal logistics in the real scenario.

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Practical implications – This study assists managers and policymakers in understanding the order in which these barriers must be tackled and adopts a strategy to successfully implement halal logistics.

Social implications – The study has indicated that the barriers to implementing halal logistics can be mitigated because these barriers have the most influence on the system identified.

Originality/value – This study considers the application of ISM methodology to an empirical case of barriers so as to implement halal logistics. The study uniquely contributes to the field of halal logistics because it represents initial research that has analysed the barriers of halal logistics using ISM methodology.

Keywords Barriers, Food, Halal logistics, ISM methodology, Beverage and ingredient companies

Paper type Research paper

Introduction

Halal is frequently related to food consumption; however, in principle, it includes all aspects of a Muslim's lifestyle, including social interaction, behaviour, speech, attire and manner (Al Jallad, 2008). Halal is an Arabic word, which is cited clearly in the Qur'an, and means allowed and lawful (Wilson and Liu, 2010). The opposite of halal is haram, which is considered to be contrary to the will of God and his Prophet Muhammad (Shallallaahu 'alaihi Wasallam), and means prohibited or unlawful. Halal is a business trademark and a symbol of quality (Lada *et al.*, 2009). With respect to food consumption, the Global Islamic Economy Report in Thomson and Reuters in 2014 indicated that the halal food market is one of the largest consumer markets in the world as a result of the growing global Muslim population. In this case, Muslims should consume halal food even if they live in minority societies (Razzaque and Chaudhry, 2013). The growth of the global Muslim population will experience a 35 per cent increase, from 1.6 billion in 2010 to 2.2 billion in 2030 (Nurrachmi, 2017). Another reason for the large halal food market is halal consumption by non-Muslims because the halal concept delivers a good platform for healthy eating and lifestyle and promotes elements of safety, hygiene and quality of products and services (Bergeaud-Blackler, 2006; Golnaz *et al.*, 2010).

Halal food consumption cannot be separated from halal food certification and halal logistics. There is a strong connection between halal food certification and halal logistics because halal is concerned with not only food products but also the point of purchase or consumption. The halal status of a product can be affected if the product has direct contact with non-halal products, unless it is completely segregated. Halal includes the whole supply chain network, from the point of origin to final consumption, from farm-to-fork. In this case, the activity of logistics ranging from transportation, warehousing, material handling, procurement and so forth must also be halal to enjoy a wholesome product or service (Ab Talib *et al.*, 2013). Therefore, halal logistics is a critical step in obtaining halal status (certified by the respective body/institution) and ensuring halal integrity for Muslim consumers. This research chooses to focus on halal logistics because most of the halal publications focus on the demand side or consumer studies and tracking and traceability of halal products (Bonne and Verbeke, 2008; Alam and Sayuti, 2011; Shafii and Khadijah, 2012). Studies focusing on the supply side of the halal food chain (halal manufacturing and halal logistics) are still rare. Consequently, the requirement, motivation or driver factors, barrier factors and other factors for implementing halal logistics remain largely unexplored. The emerging interest in halal logistics (including halal warehouse activities and transportation) and the academic publications that focus on halal logistics and supply chain fields are contributing significantly towards developing a Shariah-compliant logistics service (Jaafar *et al.*, 2011; Tieman, 2011; Tieman and van Nistelrooy, 2014; Tan *et al.*, 2012; Tieman *et al.*, 2012; Ab Talib and Mohd Johan, 2012; Kamaruddin *et al.*, 2012;

Ab Talib *et al.*, 2013; Tieman, 2013; Ngah *et al.*, 2014a; Ngah *et al.*, 2014b; Ngah *et al.*, 2015; Talib *et al.*, 2015; Firdaus *et al.*, 2016; Haleem *et al.*, 2018). This research will also enrich one's knowledge on halal logistics because most previous research uses companies in Malaysia as the case study, but this research uses companies in Indonesia as the case study.

According to Tieman (2013), halal logistics is not much different from the conventional approach. Halal logistics consists of the physical actions of storing and transporting, which offer a set of data for communication and management between consecutive links (up and down) along the food supply chain (Kamaruddin *et al.*, 2012) and apply the Shariah concept along the chain. The main principle of halal logistics is to guarantee the separation of halal cargo from non-halal cargo. Non-halal products should not be mixed with halal products in logistics activities (ranging from the source of supply, storage, transportation, handling and distribution) to guarantee that the halal status of a product is maintained. This avoids cross-contamination and ensures that the logistics system is aligned to the expectations of Muslim consumers (Jaafar *et al.*, 2013). With respect to the implementation of halal logistics, the Indonesian government launched the Halal Assurance System (HAS 23000) (Majelis Ulama Indonesia, 2008). HAS 2300 prescribes the general guidelines to manage materials, production processes, products, human resources and procedures to maintain the sustainability of the halal production process following Lembaga Pengkajian Pangan, Obat-obatan, dan Kosmetika Majelis Ulama Indonesia (The Assessment Institute for Foods, Drugs, and Cosmetics – The Indonesian Council of Ulama or LPPOM MUI) requirements. HAS 23000 consists of several elements, such as policy, management team, training and education, materials, products, facilities, written procedures of critical activity, handling procedures that do not fit halal requirements and management review. Currently, from the overall number of 204,222 food and beverage products produced by 11,246 companies, only 17,398 products have obtained a halal certificate (less than 10 per cent). This shows that a number of companies are unwilling to invest (financially, and in terms of effort and time) towards implementing HAS, because a halal certificate will only be issued by the Halal Product Assurance Organizing Agency (Badan Penyelenggara Jaminan Produk Halal or BPJPH) after the Halal Inspection Institution (Lembaga Pemeriksa Halal or LPH) checks and verifies whether the raw materials and manufacturing process are halal. On the basis of this condition, the lack of intention to implement halal logistics among food and beverage companies in Indonesia is still very puzzling. There seem to be barrier factors that discourage a positive reception among companies in implementing halal logistics. On the one hand, halal is a profitable business, and halal logistics extends halal product integrity. On the other hand, the percentage of the number of halal-certified products is still low. This study argues that a number of companies are resistant to implementing or adopting halal logistics operations. Therefore, this research attempts to highlight a gap that exists between the growing demand for halal food consumption and the insufficient willingness of food and beverage companies to implement halal logistics. The study proposes the following research questions:

RQ1. What are the barriers of halal logistics implementation?

RQ2. What is the rank of barriers for implementing halal logistics in food, beverage and ingredient companies?

RQ3. What is the relationship among the identified barriers of halal logistics implementation to derive key managerial insights?

This research uses the interpretive structural modelling (ISM) approach to find the rank of barriers for implementing halal logistics and also to find their relationship.

The rest of the paper is organised as follows. The next section presents the literature review and discusses the identification of barriers for implementing halal logistics. This is followed by an introduction to ISM, ISM methodology and ISM model development. Finally, the discussion and conclusion are presented, followed by the limitations of this research and suggestions for future research.

Literature review

Among previous studies focusing on halal logistics fields, those specifically explaining the barriers to implementing halal logistics (including halal warehouse activities and transportation) are listed in Table I.

On the basis of limited studies focusing on the halal logistics field (including halal warehouse activities and transportation), several barriers to implementing halal logistics can be drawn: lack of staff awareness and commitment of management to implement halal logistics, and organisational culture (Ngah *et al.*, 2014b; Talib *et al.*, 2015; Shadan and Arshad, 2016); lack of support for logistic service providers (LSP) (unsupportive collaboration, supplier availability) (Ab Talib *et al.*, 2013; Talib *et al.*, 2015; Ngah *et al.*, 2015; Firdaus *et al.*, 2016; Shadan and Arshad, 2016; Haleem *et al.*, 2018); lack of support from information and communication technology (traceability issues) (Ab Talib *et al.*, 2013; Talib *et al.*, 2015; Shadan and Arshad, 2016; Haleem *et al.*, 2018); lack of flexibility (lack of compatibility and upgradeability to halal logistics from the existing logistics) (Haleem *et al.*, 2018); lack of government policies and support for halal logistics (Ab Talib *et al.*, 2013; Ngah *et al.*, 2014a; Ngah *et al.*, 2015); lack of standardisation, appropriate codification and guidelines (Ab Talib *et al.*, 2013; Talib *et al.*, 2015; Haleem *et al.*, 2018); financial constraints (economic viability of logistics services with halal practices) (Ab Talib *et al.*, 2013; Talib *et al.*, 2015; Firdaus *et al.*, 2016; Shadan and Arshad, 2016; Haleem *et al.*, 2018); lack of certification experts (lack of trained halal logisticians) (Shadan and Arshad, 2016; Abid Haleem *et al.*, 2018); lack of equipment and infrastructure (lack of dedicated halal assets and facilities) (Ab Talib *et al.*, 2013; Ngah *et al.*, 2014b; Talib *et al.*, 2015; Ngah *et al.*, 2015; Firdaus *et al.*, 2016; Haleem *et al.*, 2018); lack of customer demand and reluctance to pay for halal logistics (Ngah *et al.*, 2014b; Shadan and Arshad, 2016; Haleem *et al.*, 2018); lack of global branding of halal practices (weak promotion of halal logistics) (Talib *et al.*, 2015; Haleem *et al.*, 2018); and lack of understanding the procedure of halal logistics (Ngah *et al.*, 2015; Haleem *et al.*, 2018).

Method of research

Barriers to implementing halal logistics

According to previous authors (Ngah *et al.*, 2014b; Talib *et al.*, 2015; Ab Talib *et al.*, 2013; Ngah *et al.*, 2015; Firdaus *et al.*, 2016; Shadan and Arshad, 2016; Haleem *et al.*, 2018), this study chose 13 factors as barriers to implementing halal logistics:

(1) lack of flexibility (lack of compatibility and upgradeability to halal logistics from the existing logistics) (B1);

(2) lack of government policies and support for halal logistics (B2);

(3) lack of equipment and infrastructure (B3);

(4) lack of staff awareness and organisational culture to implement halal logistics (B4);

(5) lack of standardisation, appropriate codification and guidelines (B5);

Authors	Focus and object of the research	Barriers
Ab Talib *et al.* (2013) Ngah *et al.* (2014b)	Halal logistics–Malaysia Halal transportation and warehouse activities – Malaysia	Lack of guidelines and certification issues; traceability issues and lack of dedicated halal facilities; lack of collaborative efforts; financial issues; and lack of government support and promotion Awareness; understanding; lack of competitive pressure and consumer pressure; and lack of regulation and government support
Talib *et al.* (2015)	Halal logistics – Malaysia	*Internal barriers*: capital/financial constraints; resistant to change; under-used services/infrastructure *External barriers*: Inter-firm barriers: standardisation issues; lack of dedicated halal assets/facilities; unsupportive collaboration; and traceability issues Firm–government barriers: lack of halal training and weak promotion of halal logistics Firm–authority barriers: strict halal standard; costly and time consuming halal certification process; and firm–authority communication barriers
Ngah *et al.* (2015)	Halal warehouse activities – Malaysia	Supplier availability
Firdaus *et al.* (2016)	Halal warehouse activities – Malaysia	High investment, especially for building facilities and infrastructure, and cost of policy implementation
Shadan and Arshad (2016)	Halal warehouse activities – Malaysia	Procedure less practical; lack of knowledge and experts; lack of use of information and communication technology; lack of management's commitment; lack of staff awareness; higher cost; lack of halal manufacturers' awareness; higher service prices; lack of halal retailer awareness and commitment; and lack of consumer awareness
Haleem *et al.* (2018)	Halal logistics – Malaysia	Lack of standardisation, codification and proper guidelines; economic viability of logistics services with halal practices; lack of government policies and support for halal logistics; reluctance of halal logistic service providers (LSPs) to adopt halal practices in their operations; lack of organisational culture and change management to adopt halal logistic practices; lack of compatibility and upgradeability to halal logistics from the existing logistics; lack of global branding of halal practices; lack of trained halal logisticians and lack of capacity building programmes; lack of robust information and communication technologies support; lack of agility because of ineffective coordination and collaboration among different halal LSPs; dissimilar practices and lack of dedicated halal assets and facilities; lack of customer demand and reluctance to pay for halal logistics; and lack of ethical practices and distrust in the halal integrity of the product

Table I.
Prior study about barriers of implementation halal logistics

(6) financial constraints (economic viability of logistics services with halal practices) (B6);
(7) lack of understanding the procedure of halal logistics (B7);
(8) lack of commitment of management to implement halal logistics (B8);
(9) lack of support from information and communication technology (traceability issues) (B9);
(10) lack of expertise (B10);
(11) lack of support for LSPs (unsupportive collaboration, supplier availability) (B11);
(12) lack of customer demand and reluctance to pay for halal logistics (B12); and
(13) lack of global branding of halal practices (weak promotion of halal logistics) (B13).

Interpretive structural modelling as the data processing technique

The research design for this study is exploratory and uses ISM as the data processing technique. According to previous studies on the barriers of halal logistics, numerous factors become the barriers to implementing halal logistics. This makes the structure of a systematic model of the relationship among the barriers more complex and difficult to express. Therefore, the nominal group technique to obtain a consensus about the direct relationship between two barriers and the ISM method is used for a better understanding (directly or indirectly) of the systematic structure of interaction among the barriers. By tracing back to the work of Warfield (1994) and Sage (1997), ISM can be defined as a qualitative tool in which a set of different and directly related elements is structured into a comprehensive systemic model. According to Mandal and Deshmukh (1994, p. 52), ISM is:

> [. . .] a well-established methodology for identifying and summarising relationships among specific items which define an issue or problem, it provides a means by which a group can impose order on the complexity of the items and its modelling identifies the specific relationships and overall structure, and are portrayed in a digraph model.

ISM is a suitable technique that can be used to analyse the influence of one factor over the other factors (Qureshi *et al.*, 2007).

ISM methodology has been used by several authors: by Saxena and Vrat (1990) to develop the direct or indirect relationship among key factors, objectives and activities for the conservation of energy in the Indian cement industry; by Mandal and Deshmukh (1994) to analyse the inter-relationship among several important criteria for vendor selection and to determine their levels; by Singh *et al.* (2003) to categorise important factors for implementing knowledge management in manufacturing industries; by Sharma *et al.* (1995) to identify the hierarchy of action needed to achieve successful implementation of waste management in India; by Ravi *et al.* (2005) to formulate the hierarchy (identify and rank) among the important variables for implementing reverse logistics in computer hardware supply chains; and by Ravi and Shankar (2005) to identify the direct or indirect relationship among the 11 barriers of reverse logistics in automobile industries. Huang *et al.* (2005) used ISM and analytic network process methodology to analyse subsystem interdependence and feedback relationships. Kannan and Haq (2007) used ISM methodology to analyse interactions among the criteria and sub-criteria for supplier selection. Kannan *et al.* (2008) used ISM methodology to analyse interactions

among several important criteria that were used to select green suppliers who addressed environmental performance in an automobile company. Kannan *et al.* (2009) integrated ISM methodology and fuzzy TOPSIS to analyse the third-party reverse logistics provider. Diabat and Govindan (2011) and Mathiyazhagan *et al.* (2013) used ISM methodology to analyse the drivers affecting the implementation of green supply chain management. Talib *et al.* (2011) used ISM methodology to understand the relationships among quality practices that could enhance the organisation's performance. Abdullah *et al.* (2017) used the combination of fuzzy Delphi and ISM methodology to identify the direct or indirect relationship among several important factors for developing sustainable socio-religious harmony in Malaysian multi-religious society. ISM methodology can be explained in the following steps (Chauhan *et al.*, 2018):

- Identifying relevant factors as barriers to implementing halal logistics based on a literature survey.
- Establishing the relationship between each barrier pair identified in Step 1.
- Preparing an SSIM that depicts pairwise relationships among the barriers under consideration. SSIM uses four symbols for developing the relationship between barriers *i* and *j*: V, barrier *i* will help achieve barrier *j*; A, barrier *j* will help achieve barrier *i*; X, barriers *i* and *j* will help achieve each other; and O, barriers *i* and *j* are unrelated. Next, develop the reachability matrix from SSIM. In this step, SSIM is converted into the initial reachability matrix by substituting the four symbols (V, A, X or O) of SSIM by 1 or 0 in the initial reachability matrix. For final reachability, matrix transitivity is verified. Transitivity assesses the logic of the relationship between drivers. If Barrier 1 is related to Barrier 2, and Barrier 2 is related to Barrier 3, then Barrier 1 must be related to Barrier 3.
- Partitioning the reachability matrix into different levels (reachability, antecedent and intersection).
- Drawing the ISM digraph based on the reachability matrix and the different levels obtained in Step 4 and Step 5, respectively.

Respondents of the research

In this study, a panel of experts who are representatives of food, beverage and ingredient companies in Indonesia was selected as participants. The expert is important for this study because the output of this study was based on an expert's opinion. According to Dalkey and Helmer (1963), experts can be defined as individuals who are knowledgeable in a certain field. Adler and Ziglio (1996) stressed that the selection of experts should be based on four "expertise" requirements:

(1) the expert should have knowledge as well as experience with the problems;

(2) the expert should have capacity as well as willingness to be involved;

(3) the expert should have enough time to be involved; and

(4) the expert should have effective communication skills.

Therefore, on the basis of the "expertise requirements" criteria, this study selected participants from several food, beverage and ingredient companies in Indonesia according to the following specifications:

- experts should be professionals at the middle to senior levels of management in each company and have knowledge on the implementation of halal logistics and practical involvement, and at least 5 years' experience in the subject matter;
- experts should be willing to participate and be committed to the study; and
- experts should be interested in the aims and results of the study.

According to Lai *et al.* (2008), executives at middle to senior levels are knowledgeable and involved in logistics innovations.

After repeated phone calls and direct visits to LPPOM MUI and several food, beverage and ingredient companies in Indonesia, LPPOM MUI and 23 companies were interested in this research work. The companies being selected were from growth and stable companies. The demographic profiles of the companies and their representatives are given in Table II. Out of the 23 companies, 15 were food companies (65.22 per cent), three were beverage companies (13.04 per cent), one was a food and beverage company (4.35 per cent) and four were ingredient companies (17.39 per cent). According to employee size, five companies had 20-100 employees (21.74 per cent), 15 had 101-1,000 employees (65.22 per cent) and three had 1,001-5,000 employees. According to the representatives of the companies who filled out the questionnaire, 15 were middle managers (65.22 per cent) and eight were senior managers (34.78 per cent). According to their work experience, 15 had 5 until less than 10 years' work experience, two had 10 until less than 15 years' work experience and six had 15 or more years' work experience.

Result of a structural self-interaction matrix and a reachability matrix. As ISM methodology suggests, this study uses a nominal group technique to develop the direct relationship between two barriers. In this case, to analyse the barriers, a contextual

Profile	Total	(%)
Type of companies		
Food companies	15	65.22
Beverage companies	3	13.04
Food and beverage companies	1	4.35
Ingredient companies	4	17.39
Total	23	100.00
Size (employee)		
20-100	5	21.74
101-1,000	15	65.22
1,001-5,000	3	13.04
Total	23	100.00
The level of management of representatives who filled out the questionnaire		
Middle manager	15	65.22
Senior manager	8	34.78
Total	23	100.00
The working experience of representative who filled out the questionnaire		
5 to less than 10 years	15	65.22
10 to less than15 years	2	8.70
15 years or more	6	26.09
Total	23	100.00

Table II.
The profile of the companies and their representatives

relationship of "leads to" is chosen. This means that one variable leads to another variable. Thus, a contextual relationship between the variables is developed. As mentioned before, four symbols are used to indicate the relationship between barrier *i* and barrier *j* (V, A, X and O). The SSIM for the barriers in implementing halal logistics is given in Table III. The following section explains the use of the symbols V, A, X and O in SSIM. Lack of flexibility (lack of compatibility and upgradeability to halal logistics from the existing logistics) (B1) will help achieve a lack of standardisation, appropriate codification and guidelines (B5); hence, the relationship of V is denoted for B1 and B5 in SSIM. Lack of flexibility (lack of compatibility and upgradeability to halal logistics from the existing logistics) (B1) can be achieved by a lack of global branding of halal practices (weak promotion of halal logistics) (B13). Hence, the relationship between B1 and B13 is denoted by A in SSIM. Lack of flexibility (lack of compatibility and upgradeability to halal logistics from the existing logistics) (B1) and lack of support for LSPs (unsupportive collaboration, supplier availability) (B11) help achieve each other. Hence, this relationship between the barriers is denoted by X. No relationship exists between lack of flexibility (lack of compatibility and upgradeability to halal logistics from the existing logistics) (B1) and lack of customer demand and reluctance to pay for halal logistics (B12); hence, the relationship between these barriers is denoted by "O" in SSIM.

The initial reachability matrix is developed by transforming the information of each cell of SSIM into binary digits (i.e. ones or zeros). In this case, if the entry in cell (*i*, *j*) in SSIM is V, then the cell (*i*, *j*) entry becomes 1 and the cell (*j*, *i*) entry becomes 0. If the entry in cell (*i*, *j*) in SSIM is A, then the cell (*i*, *j*) entry becomes 0 and the cell (*j*, *i*) entry becomes 1 in the initial reachability matrix. If the entry in cell (*i*, *j*) in SSIM is X, then the entries in both cells (*i*, *j*) and (*j*, *i*) become 1 in the initial reachability matrix. If the entry in cell (*i*, *j*) in SSIM is O, then the entries in both cells (*i*, *j*) and (*j*, *i*) become 0 in the initial reachability matrix. The result of the initial reachability matrix can be seen in Table IV.

Table V shows the final reachability matrix for the barriers. This matrix is obtained by incorporating the transitivity process. In this process, if barrier *i* is related to barrier *j* and barrier *j* is related to barrier *x*, then barrier *i* should be related to barrier *k*. The transitivity is marked by *.

	Second barrier												
	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1
First barrier													
B1	A	O	X	A	O	A	X	A	V	O	X	V	
B2	A	V	V	X	O	A	A	A	X	A	A		
B3	A	V	V	A	X	O	X	O	A	O			
B4	O	A	V	X	A	A	V	A	X				
B5	X	V	V	X	O	X	X	X					
B6	O	V	V	A	V	O	V						
B7	O	O	V	O	X	O							
B8	O	O	O	V	V								
B9	A	V	O	X									
B10	X	O	O										
B11	O	X											
B12	O												
B13													

Table III.
The SSIM for the barriers in the implementation of halal logistic

	Second barrier												
	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13
First barrier													
B1	1	1	1	0	1	0	1	0	0	0	1	0	0
B2	0	1	0	0	1	0	0	0	0	1	1	1	0
B3	1	1	1	0	0	0	1	0	1	0	1	1	0
B4	0	1	0	1	1	0	1	0	0	1	1	0	0
B5	0	1	1	1	1	1	1	1	1	1	1	1	1
B6	1	1	0	1	1	1	1	0	1	0	1	1	0
B7	1	1	1	0	1	0	1	0	1	0	1	0	0
B8	1	1	0	1	1	0	0	1	1	1	0	0	0
B9	0	0	1	1	0	0	1	0	1	1	0	1	0
B10	1	1	1	1	1	1	0	0	1	1	0	0	1
B11	1	0	0	0	0	0	0	0	0	0	1	1	0
B12	0	0	0	1	0	0	0	0	0	0	1	1	0
B13	1	1	1	0	1	0	0	0	1	1	0	0	1

Table IV.
Initial reachability matrix

	Second barrier														
	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	Driving power	Rank
First barrier															
B1	1	1	1	0	1	0	1	0	0	0	1	0	0	6	4
B2	0	1	0	0	1	0	0	0	0	1	1	1	0	5	5
B3	1	1*	1	0	0	0	1	0	1	0	1*	1	0	7	3
B4	0	1	0	1	1	0	1	0	0	1	1	0	0	6	4
B5	0	1	1	1*	1	1	1*	1	1	1	1*	1	1	12	1
B6	1	1	0	1	1*	1	1	0	1	0	1	1	0	9	2
B7	1	1*	1	0	1	0	1	0	1	0	1	0	0	7	3
B8	1	1	0	1	1	0	0	1	1*	1	0	0	0	7	3
B9	0	0	1	1	0	0	1	0	1	1	0	1	0	6	4
B10	1	1	1	1*	1	1	0	0	1	1*	0	0	1	9	2
B11	1	0	0	0	0	0	0	0	0	0	1	1	0	3	6
B12	0	0	0	1	0	0	0	0	0	0	1	1	0	3	6
B13	1	1	1	0	1	0	0	0	1	1	0	0	1	7	3
Dependence	8	10	7	7	9	3	7	2	8	7	9	7	3		
Rank	3	1	4	4	2	5	4	6	3	4	2	4	5		

Table V.
Final reachability matrix

Note: *The transitivity (transitivity of the contextual relation is a basic assumption in ISM which states that if element A is related to B and B is related to C, then A will be necessarily related to C)

Partitioning the reachability matrix. The next step is making the level partitioning. According to Warfield (1974), from the final reachability matrix, we can obtain the reachability set and the antecedent set for each variable. The reachability set for a specific barrier contains the barrier itself and other barriers, which it may support to attain. Similarly, the antecedent set for a specific barrier contains the barrier itself and other barriers, which supports in attaining it. Subsequently, the intersection between the reachability set and the antecedent set is reached. The variable for which the reachability and the intersection sets are the same is given the top-level variable in the ISM hierarchy, which would not help achieve any other variable above their own level. After identification of the top-level element, it is excluded from the other remaining variables. Table VI presents

Level	Barrier	Reachability set	Antecedent set	Intersection set
I	1	1, 2, 3, 5, 7, 11	1, 3, 6, 7, 8, 10, 11, 13	1, 3, 7, 11
	2	2, 5, 10, 11, 12	1, 2, 3, 4, 5, 6, 7, 8, 10, 13	2, 5, 10
	3	1, 2, 3, 7, 9, 11, 12	1, 3, 5, 7, 9, 10, 13	1, 3, 7, 9
	4	2, 4, 5, 7, 10, 11	4, 5, 6, 8, 9, 10, 12	4, 5, 10
	5	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13	1, 2, 4, 5, 6, 7, 8, 10, 13	2, 4, 5, 6, 7, 8, 10, 13
	6	1, 2, 4, 5, 6, 7, 9, 11, 12	5, 6, 10	5, 6
	7	1, 2, 3, 5, 7, 9, 11	1, 3, 4, 5, 6, 7, 9	1, 3, 5, 7, 9
	8	1, 2, 4, 5, 8, 9, 10	5, 8	5, 8
	9	3, 4, 7, 9, 10, 12	3, 5, 6, 7, 8, 9, 10, 13	3, 7, 9, 10
	10	1, 2, 3, 4, 5, 6, 9, 10, 13	2, 4, 5, 8, 9, 10, 13	2, 4, 5, 9, 10, 13
	11	*1, 11, 12*	1, 2, 3, 4, 5, 6, 7, 11, 12	*1, 11, 12*
	12	*11, 12*	2, 3, 5, 6, 9, 11, 12	*11, 12*
	13	1, 2, 3, 5, 9, 10, 13	5, 10, 13	5, 10, 13
II	1	1, 2, 3, 5, 7	1, 3, 6, 7, 8, 10, 13	1, 3, 7
	2	*2, 5, 10*	*1, 2, 3, 4, 5, 6, 7, 8, 10, 13*	*2, 5, 10*
	3	1, 2, 3, 7, 9	1, 3, 5, 7, 9, 10, 13	1, 3, 7, 9
	4	2, 4, 5, 7, 10	4, 5, 6, 8, 9, 10	4, 5, 10
	5	2, 3, 4, 5, 6, 7, 8, 9, 10, 13	1, 2, 4, 5, 6, 7, 8, 10, 13	2, 4, 5, 6, 7, 8, 10, 13
	6	1, 2, 4, 5, 6, 7, 9	5, 6, 10	5, 6
	7	1, 2, 3, 5, 7, 9	1, 3, 4, 5, 6, 7, 9	1, 3, 5, 7, 9
	8	1, 2, 4, 5, 8, 9, 10	5, 8	5, 8
	9	3, 4, 7, 9, 10	3, 5, 6, 7, 8, 9, 10, 13	3, 7, 9, 10
	10	1, 2, 3, 4, 5, 6, 9, 10, 13	2, 4, 5, 8, 9, 10, 13	2, 4, 5, 9, 10, 13
	13	1, 2, 3, 5, 9, 10, 13	5, 10, 13	5, 10, 13
III	1	1, 3, 5, 7	1, 3, 6, 7, 8, 10, 13	1, 3, 7
	3	*1, 3, 7, 9*	*1, 3, 5, 7, 9, 10, 13*	*1, 3, 7, 9*
	4	4, 5, 7, 10	4, 5, 6, 8, 9, 10	4, 5, 10
	5	3, 4, 5, 6, 7, 8, 9, 10, 13	1, 4, 5, 6, 7, 8, 10, 13	4, 5, 6, 7, 8, 10, 13
	6	1, 4, 5, 6, 7, 9	5, 6, 10	5, 6
	7	*1, 3, 5, 7, 9*	1, 3, 4, 5, 6, 7, 9	*1, 3, 5, 7, 9*
	8	1, 4, 5, 8, 9, 10	5, 8	5, 8
	9	3, 4, 7, 9, 10	3, 5, 6, 7, 8, 9, 10, 13	3, 7, 9, 10
	10	1, 3, 4, 5, 6, 9, 10, 13	4, 5, 8, 9, 10, 13	4, 5, 9, 10, 13
	13	1, 3, 5, 9, 10, 13	5, 10, 13	5, 10, 13
IV	1	1, 5	1, 6, 8, 10, 13	1
	4	*4, 5, 10*	*4, 5, 6, 8, 9, 10*	*4, 5, 10*
	5	4, 5, 6, 8, 9, 10, 13	1, 4, 5, 6, 8, 10, 13	4, 5, 6, 8, 10, 13
	6	1, 4, 5, 6, 9	5, 6, 10	5, 6
	8	1, 4, 5, 8, 9, 10	5, 8	5, 8
	9	4, 9, 10	3, 5, 6, 7, 8, 9, 10, 13	9, 10
	10	1, 4, 5, 6, 9, 10, 13	4, 5, 8, 9, 10, 13	4, 5, 9, 10, 13
	13	1, 5, 9, 10, 13	5, 10, 13	5, 10, 13
V	1	1, 5	1, 6, 8, 10, 13	1
	5	5, 6, 8, 9, 10, 13	1, 5, 6, 8, 10, 13	5, 6, 8, 10, 13
	6	1, 5, 6, 9	5, 6, 10	5, 6
	8	1, 5, 8, 9, 10	5, 8	5, 8
	9	*9, 10*	*3, 5, 6, 7, 8, 9, 10, 13*	*9, 10*
	10	1, 5, 6, 9, 10, 13	5, 8, 9, 10, 13	5, 9, 10, 13
	13	1, 5, 9, 10, 13	5, 10, 13	5, 10, 13
VI	1	1, 5	1, 6, 8, 10, 13	1
	5	*5, 6, 8, 10, 13*	*1, 5, 6, 8, 10, 13*	*5, 6, 8, 10, 13*
	6	1, 5, 6	5, 6, 10	5, 6

(*continued*)

Table VI.
Level partitions for barriers: Iteration I-Iteration VIII

Level	Barrier	Reachability set	Antecedent set	Intersection set
	8	1, 5, 8, 10	5, 8	5, 8
	10	1, 5, 6, 10, 13	5, 8, 10, 13	5, 10, 13
	13	1, 5, 10, 13	5, 10, 13	5, 10, 13
VII	*1*	*1*	*1, 6, 8, 10, 13*	*1*
	6	1, 6	6, 10	6
	8	1, 8, 10	8	8
	10	1, 6, 10, 13	8, 10, 13	10, 13
	13	1, 10, 13	10, 13	10, 13
VIII	*6*	*6*	*6, 10*	*6*
	8	8, 10	8	8
	10	6, 10, 13	8, 10, 13	10, 13
	13	*10, 13*	10, 13	*10, 13*
IX	8	8, 10	8	8
	10	*10*	*8, 10*	*10*
X	*8*	*8*	*8*	*8*

Note: The numbers with the italic text in first colum indicated the same value between reachability and the intersection sets and those values will be excluded from the other remaining variables to occupy the certain level

Table VI.

the 13 barriers along with their reachability set, antecedent set, intersection set and levels. The level partitioning is completed in ten iterations. Table VI shows the first iteration, wherein lack of support for LSPs (unsupportive collaboration, supplier availability) (B11) and lack of customer demand and reluctance to pay for halal logistics (B12) are found at level I; therefore, they are positioned at the top of the ISM hierarchy. These barriers are followed by lack of government policies and support for halal logistics (B2), which are found at level II; thus, lack of equipment and infrastructure (B3) and lack of understanding the procedure of halal logistics (B7) are placed at the barrier in Level III, etc. The final model of ISM based on level partitioning is given in Figure 1. The connection between barriers j and i is presented by an arrow directed from i to j. The resulting graph is called a digraph. Removing the transitivity as described in ISM methodology, the digraph is finally converted into the ISM model. Figure 1 demonstrates that lack of commitment of management to implement halal logistics (B8) is a very significant barrier to implementing halal logistic practices for food, beverage and ingredient companies as it forms the base of ISM.

Matrice d'Impacts croises-multiplication appliqúe an classment analysis. Matrice d'Impacts croises-multiplication appliqúe an classment (cross-impact matrix multiplication applied to classification) or MICMAC analysis is an indirect classification technique based on the driving power and dependence of each variable (Mandal and Deshmukh, 1994; Ravi *et al.*, 2005). MICMAC analysis helps in investigating the scope of each variable. From Table IV (final reachability matrix), the driving power and dependence are acquired by adding an entry of binary digit "1" in the respective row and column for each barrier for implementing halal logistics. The driving power and dependence of each practice can be plotted as the matrix diagram shown in Figure 2. For example, Table IV shows that Barrier 1 (B1) has a driving power of "6" and a dependence of "8". Therefore, in Figure 2, it is positioned at a place corresponding to a driving power of "6" and a dependence of "8". In MICMAC analysis, the barriers to implementing halal logistics described earlier are classified into four quadrants based on the driving power and the dependence. The first quadrant represents "autonomous barriers". Barriers belonging to this quadrant have weak

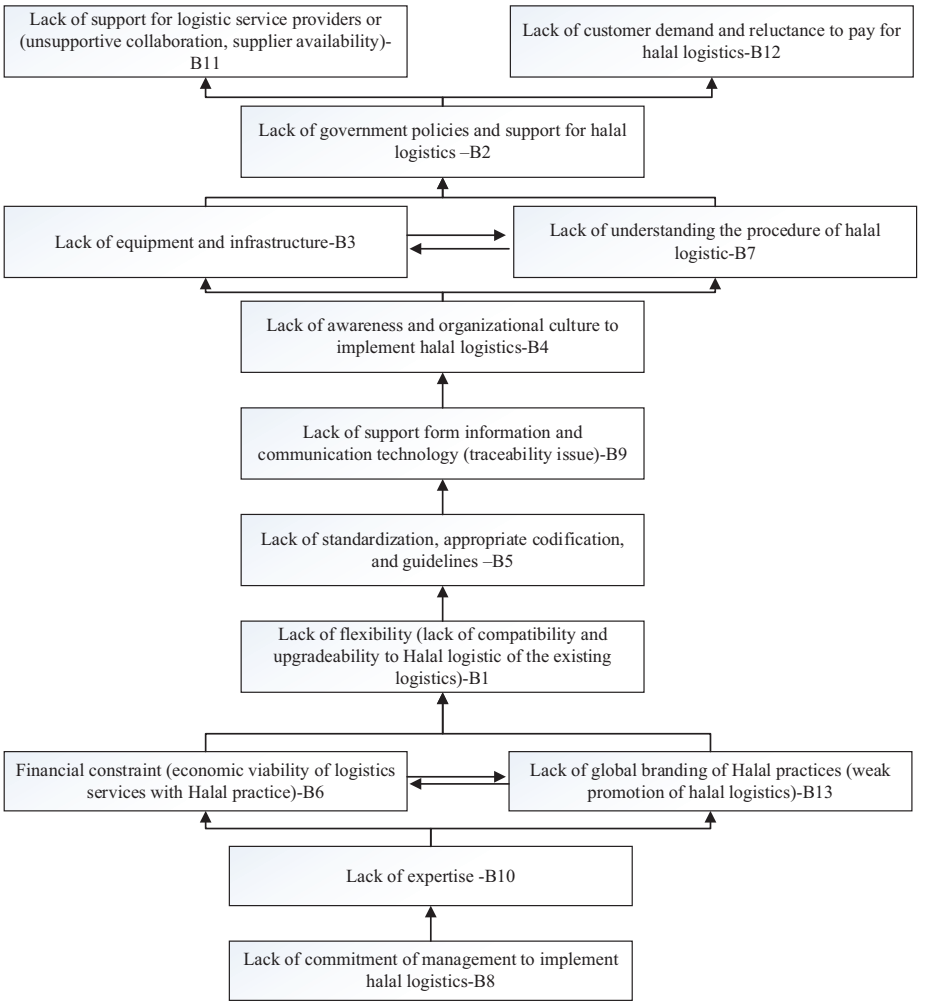

Figure 1.
ISM model for barriers in implementing halal logistic

driving power and weak dependence. These barriers are relatively disconnected from the system because they hold few weak links with other barriers. The second quadrant represents "dependent barriers". Barriers belonging to this quadrant have weak driving power but strong dependence. The third quadrant represents "linkage barriers". Barriers belonging to this quadrant have strong driving power and strong dependence. These barriers are unstable because any action on them will affect other barriers and also feedback on themselves. The fourth quadrant represents "independent barriers". Barriers belonging to this quadrant have strong driving power but weak dependence. The driving power and dependence of each barrier are depicted in Figure 2.

The result of mapping the driving power and dependence power of each barrier in Figure 2 indicates the following:

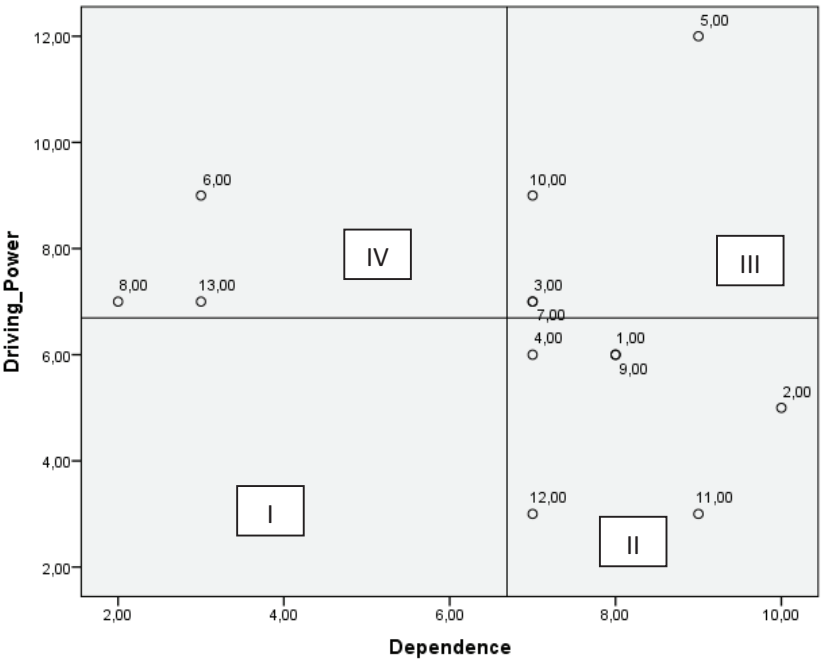

Figure 2.
Driving power and dependence power diagram

- There are no barriers in the autonomous barrier quadrant (Quadrant I). The non-appearance of such barriers in this study indicates that all the considered barriers play an important role.
- Six barriers fall in Quadrant II or dependent barriers: lack of flexibility (B1), lack of government policies and support for halal logistics (B2), lack of awareness and organisational culture to implement halal logistics (B4), lack of support from information and communication technology (traceability issues) (B9), lack of support for LSPs (unsupportive collaboration, supplier availability) (B11) and lack of customer demand and reluctance to pay for halal logistics (B12).
- Three barriers fall in Quadrant III or linkage barriers: lack of equipment and infrastructure (B3), lack of understanding the procedure of halal logistics (B7) and lack of expertise (B10).
- Three barriers fall in Quadrant IV or independent barriers: financial constraints (economic viability of logistics services with halal practice) (B6), lack of commitment of management to implement halal logistics (B8) and lack of global branding of halal practices (weak promotion of halal logistics) (B13). With respect to financial constraints, Manzouri *et al.* (2013) shared the same view and underlined weak financial support as a barrier in implementing changes or purchasing new equipment. This is understandable, as halal logistics requires its own set of dedicated facilities, equipment and infrastructure (Talib *et al.*, 2015; Jaafar *et al.*, 2011); the lack of financial constraints can drive the emergence of other obstacles

such as lack of equipment to implement halal logistics, etc. Moreover, halal activities (such as budget, marketing, staff development programmes and halal logistics) are difficult to carry out when there is a lack of management's commitment (Shadan and Arshad, 2016). In a number of studies, the commitment of management is a variable representing the organisational context. The findings for this barrier with higher driving power are consistent with those of Lertwongsatien and Wongpinunwatana (2003), Low *et al.* (2011) and Alshamaila *et al.* (2013), who found that management attitudes positively influenced the adoption of new technology. Then, the lack of global branding of halal logistics could drive the other barriers: for example, the lack of practice of halal cannot assist corporations in achieving worldwide acknowledgement and credibility, and be a major player in this lucrative market (Borzooei and Asgari, 2013). It may discourage the company from having the equipment, making an investment or performing other actions related to the implementation of halal logistics.

Conclusion

Halal should exist at the point of origin of the supply chain until it reaches the customer's destination (Omar and Jaafar, 2011). Throughout the process, halal logistics should be included, as most manufacturers make their products at a different location from their market and obtain their raw material needs for the production process from the other location. Halal logistics guarantees the separation of halal cargo from non-halal cargo and applies the *Shariah* concept along the chain. Moreover, halal-compliant logistics services are important in inhibiting cross-contamination between halal and non-halal products during transportation and distribution (Tieman *et al.*, 2012). However, according to our preliminary study, it appears that a number of undermining factors discourage a positive reception among companies towards adopting halal logistics. On the one hand, halal is a profitable business and halal logistics extends the integrity of halal products. On the other hand, there are several barriers to adopting halal logistics. Therefore, accordingly, this study is an early attempt to explore and develop the barrier of implementation of halal logistics by adopting ISM methodology.

The findings show that there are 13 barriers that may inhibit companies in implementing halal logistics. On the basis of inputs from 24 experts (one from LPPOM MUI and 23 from middle to senior managers of 23 food, beverage and ingredient companies in Indonesia who were willing to participate and gave full commitment to the study), an SSIM was constructed, which was the foundation for ISM. These barriers were iterated in t levels. According to the structure in ISM, lack of support for LSPs (B11) and lack of customer demand and reluctance to pay for halal logistics (B12) occupied the topmost level. These barriers were affected at the lower level and also had less influence than the remaining barriers. According to the representative from LPPOM MUI and the representatives from 23 companies, these barriers are comparatively easy to eradicate. The lack of support for LSPs is related to the initial effort by companies before they had recognised halal logistics services; it is not an easy process and represents a significant challenge to companies because a worldwide halal certification standard does not exist. There are so many sets of halal practices that depend on the countries and their halal authorities (Abdul-Talib and Abd-Razak, 2013; Rahman *et al.*, 2013; Tieman and Ghazali, 2013). Furthermore, the halal certification process is stringent, tedious, time-consuming, not user-friendly and costly (Noordin *et al.*, 2014; Talib *et al.*, 2015c), which means that the LSP should prepare the cost towards investing in the certification (Kamaruddin *et al.*, 2012). The halal logistics service needs to incorporate costs to achieve the halal compliance parameter. The barrier of lack of

customer demand and reluctance to pay for halal logistics (B12) can be a threat to the success of halal logistics and can affect consumers' demand for these services (Kamaruddin *et al.*, 2012). Basically, there is a correlation between lack of support for LSPs (B11) and lack of customer demand and reluctance to pay for halal logistics (B12). This can also be seen in Figure 1. In this case, the positive response from consumers to pay for halal logistics can encourage LSPs to invest in halal-dedicated assets such as halal warehousing, halal seaport activities, halal transportation and carriers, halal-only equipment, halal audit teams and halal tracking (Jaafar *et al.*, 2011; Kamaruddin *et al.*, 2012; Talib and Johan, 2012). This means that the negative response from customers to pay for halal logistics can discourage LSPs from investing in halal-dedicated assets and the certification process.

According to SSIM, the result of this study shows that lack of commitment of management to implement halal logistics (B8) is the main barrier in implementing halal logistics. Companies need to give special attention and first priority to removing this barrier. According to Stouten *et al.* (2018), the readiness of an organisation to implement, or adopt, a new situation is influenced by:

- employees who are capable of implementing change and who propose changes that are appropriate for the organisation;
- a leader who is committed to the changes; and
- management that supports the proposed changes.

Support from management is significant to deliver ideas and correct directions towards achieving a halal logistics process and actions. This will help the entire organisation to be ready and able to implement a halal logistics system and, moreover, offer appropriate preparation to face any failure, problems or risk (Tarmizi *et al.*, 2014). In addition, organisational culture may be the factor that influences logistics players to be ready to implement halal logistics (Tarmizi *et al.*, 2014).

This research has some implications for increasing the implementation of halal logistics. By diagnosing the dominant barriers, the fear of implementing halal logistics can be eliminated. This research might act as a valuable input for the process of decision-making by companies who need to implement halal logistics to attain competitive advantage. In the implementation phase of halal logistics, the management of any company cannot emphasise all the barriers simultaneously; the management needs to classify the barriers into several clusters for ease of implementation. Moreover, after classification, the management needs to recognise which barriers influence the system the most to mitigate them at an early stage. Then, by frequently mitigating the barriers based on their classification, strategic results can be attained. With respect to the major cause indicated by the ISM model (Figure 1), policymakers should focus on providing training or conducting a workshop to increase the awareness of employees of the company and also to obtain support from the top management regarding halal logistics implementation. The workshop should include procedures for obtaining recognition for halal logistics implementation.

This study contributes to the current body of knowledge by emphasising barriers to the implementation of halal logistics. The identified barriers guide the food, beverage and ingredient companies to focus on, and mitigate, them. The inter-relationships among the barriers to implementing halal logistics offer support in developing strategies to mitigate the identified barriers. The most driving power barriers need to be addressed on priority. There is a dearth of empirical studies in the field of halal logistics, and this study used an empirical technique (i.e. ISM methodology) that can assist more scrutinised research and aid in developing a method to assess the barriers of implementing halal logistics.

Several limitations, however, need to be highlighted:

- The scope of this study is limited to the barriers faced by Indonesian food, beverage and ingredient companies and overlooks other barriers to halal logistics encountered by other industries or other services as well as other regions or countries (i.e. other Muslim or non-Muslim countries). Future studies should attempt to uncover other industries or other services or a cross-industry comparison to have a greater understanding of the main barriers in other industries or other services (such as barriers in implementing halal pharmaceuticals or cosmetics, halal marketing and halal tourism). Future studies should also attempt to uncover other regions or other countries as well as perform a cross-region or even cross-country comparison because halal logistics operations could vary between countries (Tieman *et al.*, 2012).
- Another limitation of this study is related to the possibility of biased opinions from the experts.
- Finally, the identified barriers do not test in a real environment.

To eliminate this limitation, future studies should involve more experts from different areas of the halal industry. Future research should also test the identified barriers to implement halal logistics in the real scenario or even make the simulation model to test the effect of barriers on halal logistics implementation. Testing the barrier in a real situation can be carried out by gathering more information from a larger sample, and attention should be paid to highlighting the "driving power barriers" and the "dependent barriers".

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Further reading

Hezin, S. and Arshad, N.H. (2016), "Issues in Halalan-Toyyiban warehouse implementation", *J. Appl. Environ. Biol. Sci*, Vol. 6 No. 9S, pp. 1-7.

About the authors

Dr Aries Susanty is Professor in the field of Industrial Engineering and also a Lecturer at the Department of Industrial Engineering, Diponegoro University, Semarang, Indonesia. She obtained her Doctoral in Industrial Engineering from the Bandung Institute of Technology. She served as Secretary of Master Program of Industrial Engineering and Management from 2017. Through her 20+ years of experience in teaching and research in the Diponegoro University, she has established an overarching research area in supply chain modelling, supply chain governance, supply chain policy, procurement and logistics strategy and organisation behaviour. Her research track record has been demonstrated by winning a number of research grants from Indonesia government and

Diponegoro University. She has published more than 50 technical papers in journals and conferences. She also coordinated multiple academic and industrial research projects. She has successfully completed the supervision of five master students and over 60 undergraduate students. Aries Susanty is the corresponding author and can be contacted at: ariessusanty@gmail.com

Nia Budi Puspitasari is a Lecturer in the Department of Industrial Engineering, Diponegoro University. She obtained her Master Degree in Industrial Engineering from the Bandung Institute of Technology. Her research interests include management, organization, sustainable tourism and tourism development and planning.

Avika Dian Caterina is a graduate from Industrial Engineering Department, Diponegoro University. Her research interests include supply chain modelling and green supply chain practice.

Sumunar Jati is Deputy Director of LPPOM MUI. His research interests include management, organization and halal implementation.